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ABSTRACT

A study was conducted at Miami-Dade Community College to establish a profile of students enrolled in mathematics courses at the college's Learning Support Center (LSC) and to evaluate the courses' success in terms of student outcomes. The subjects of the study were students enrolled during 1976 in Mathematics 179 courses, which provided students with individualized, self-paced, mathematics instruction in a laboratory setting. Findings, based on data on 963 students, indicated that: (1) females outnumbered males in three of the four terms of 1976; (2) student ages ranged from below 15 to 69, and the mean age ranged from 24.3 to 26.1; (3) approximately 75% of the students were continuing students; (4) 50.7% were whites, 29.13% were blacks, and 19.53% were Hispanics; (5) a consistent positive relationship was found between students' grade point average and pre-test diagnostic math scores; (6) student pre-test scores were not a factor in determining whether a student completed or withdrew from the LSC math course; and (7) significant improvements in students' post-test scores over pre-test scores were observed, with the level of improvement varying according to ethnic background. Findings indicated that the LSC math course has been responsive to individual student needs and has led to an improvement in students' mathematics proficiency. The study report includes a description of the LSC's programs and methods of testing and instruction, and cross tabulates survey findings. (HB)

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A ONE-YEAR PROFILE AND EVALUATION OF THE LEARNING SUPPORT CENTER'S MATHEMATICS COURSES

1976

Miami-Dade Community College, South Campus

JC 810 421

by

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December 1978

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Introduction

Miami-Dade Community College is an open-door institution of post-secondary education. The open-door allows admittance to any adult who can profit from what the college has to offer, regardless of previous academic performance.

Miami-Dade Community College, South, in order to meet the diverse educational needs of these entering students, developed the Division of Learning Support Services in the Spring of 1974. The purpose of this new division was to provide any student registered at the college with academic assistance in the basic skills of reading and writing. Math was introduced into the Learning Support Center curriculum in the Fall of 1976. This report is a one-year profile and evaluation of the Learning Support Center Mathematics Courses.

Description of the Program

At the beginning of every semester, all students who register for an introductory course in algebra are given a diagnostic test in math. At the time of testing, an effort is made to free the student from any fear he may have of the examination. It is explained that the purpose of the test is to be able to inform the student of his knowledge of the basic skills of mathematics.

The tests are machine scored, and the results of the test are returned to the student by the math staff of the Learning Support Center. At the time the test results are returned, the services of

the Learning Support Center (LSC) and its method of instruction are explained to the student. The student is free, regardless of the test score, to decide if he will avail himself of this academic assistance, for registration in the Learning Support Center is voluntary.

The student who registers in the LSC for assistance in math may be deficient in basic arithmetic or may be registered in an advanced math course and need additional assistance in order to complete the course successfully. The math courses taught in the LSC range from basic arithmetic through calculus.

The instruction in the LSC is completely individualized based on prescription programming. A program of study is written for each student in math based on that student's academic needs and the course objectives of math as they are taught in the LSC. The math courses taught in the lab have a set of course objectives. The math student who registers in the LSC need not complete all the course objectives offered in math by the LSC. The student and the instructor mutually decide the objectives the student will complete during the program based on the student's academic needs in the area of mathematics. At the completion of an objective, a criterion-referenced test is administered to the student on that objective. The number of objectives the student is required to complete depends upon the number of credits for which the student has registered and the quality of the final grade he hopes to receive.

The LSC offers variable credit. This means that a student may register for one, two, or three credits over a fifteen-week

period of time. The student, in deciding the number of credits he will take, obligates himself to a time requirement. A student who registers for one credit in the LSC is required to spend twelve hours and thirty minutes on his program in the lab. A student who registers for two credits in the LSC is required to spend twenty-five hours on his program in the lab. A student who registers for three credits in the LSC is required to spend thirty-seven hours and thirty minutes on his program in the lab. This is the same time requirement placed on a student in a traditional classroom. A student who does not complete the time requirements for a specific number of credits receives an incomplete as his final grade. The student may return the next semester and complete the program. The grading policy of the LSC is distributed to the student, and the student at the initial conference with his instructor decides the grade for which he will work.

The basic skills program in the LSC is completely non-scheduled. The lab is open from 8:00 A.M. to 10:00 P.M., Monday through Thursday, and from 8:00 A.M. to 6:00 P.M. on Fridays. The student, because of a specially designed time card and a computerized attendance record, can work on his program any time during these hours and any day of the week. The only time the student must report to the LSC at a particular time and on a particular day is for his weekly conference with his instructor. These conferences are mandatory for it is at these conferences that the student's progress is discussed and additions are made to the student's prescription program.

The student on entering the lab "clocks in" and writes his name and student number on the time card. All the material in the LSC has a computer code attached to it. The code indicates the title and the difficulty of the material. The student records on the time card the computer code attached to the material he uses while in the lab. The student exiting from the lab "clocks out" and deposits his card next to the time clock. Each morning these cards are taken to key-punch by a student assistant, and once a week computer services supplies the LSC with a printout that records attendance, length of time spent in the lab and materials used by students who "clocked in" the LSC the previous week. The time recorded by each student's name is cumulative so the student is informed once a week of the number of hours he has accumulated toward the time commitment he made when selecting the number of credits for which he registered. This same printout provides the staff with a list of the total lab population and the date they last "clocked in" at the LSC. When a student has not been to the lab for two weeks, a letter is sent to the student reminding him of his obligation. This letter may surprise the student, for nonscheduled is sometimes confused with nonstructured. The LSC offers a nonscheduled learning environment but the learning process in the lab is highly structured. It is this structure that offers flexibility to the program while insuring accountability to the student and to the administration at Miami-Dade, South Campus.

The individuality within the structure is further enhanced by continuous registration. The student is told at the time of

receiving his test score that, regardless of grade placement on the math test, enrollment in the LSC is voluntary. It is impressed on the student at this time that should he decide not to register in the lab now, but later finds a need for this academic assistance, he may return anytime up to the last three weeks of the term, register, receive the help he needs, and credit for the work he accomplishes. Continuous registration is an important part of the educational program offered in the LSC. It allows the student to make the wrong decision at the beginning of the semester, but provides for academic assistance when the student realizes he needs it. The fact that enrollment in the LSC is voluntary, regardless of the grade placement achieved on the pretest, puts the responsibility of seeking academic assistance on the student. Few incoming freshmen can anticipate the class requirements that will be assigned as the semester advances. It would be unfair and would dilute the effectiveness of the program if the student had only one chance each semester to avail himself of this academic support.

Self-paced progression is an important part of any individualized approach to education. The student must be free to progress at his own rate and on a level of instruction that is free of frustration. As previously stated, the student, who registers in the basic skills program in the LSC, must complete a certain number of course objectives and spend a specific number of hours on the program in order to receive a final passing grade and credit for the course. Both the completion of the objectives and the completion

of the time requirement are left to the discretion of the individual. The progress of the student is assessed each week by the instructor, but no pressure is placed on the student to complete the program by a particular calendar date. The emphasis in the LSC is on learning and not on time. The student may finish his program as quickly or as slowly as he desires. A student who does not complete his program during a fifteen-week semester, simply re-registers for the course, pays his tuition and continues his program the next semester.

It is important to differentiate between the final grade received in the LSC and the amount of credit acquired. The number of objectives to be completed in the program is based on the number of credits the student has chosen to receive. When the student decides that he has mastered the content of an objective, he requests the criterion-referenced test appropriate to that objective. If the student passes the test, he is credited with the completion of that objective and proceeds to another objective or another level of performance. The quality of the student's work in completing the objectives and the academic progress he makes determines the student's final grade in the LSC. The number of hours spent in the lab on the program decides the number of credits the student will receive from the LSC. The LSC places on the student a minimum level of performance and a minimum time requirement for successfully completing the basic skills program, but beyond this it is an open entrance/open exit learning experience which allows the student to advance as far as it is possible for him to go.

One of the reasons the student is able to advance at his own rate and on his own instructional level is because of the multilevel/multimedia materials in the LSC. The traditional textbook has been abandoned by the LSC and has been replaced with materials that span levels from first grade to advanced college work. The multilevel materials allow the student to start his program on his instructional level which assures that academic success is built into the program. The multimedia material provides the student with a variety of learning modes and offers him a choice of learning styles. All of this material is attractively displayed in open shelves in the LSC to resemble a supermarket. The student is free to handle, examine and use any type of material that may attract his attention.

The instructors in the LSC are learning facilitators rather than classroom instructors. They are hired with the understanding that their role in the lab will be a radical departure from the position held by most college educators. They meet with their students once a week in an individual conference at which course objectives are mutually determined, the student's progress is discussed and the student's prescription program is extended to include new skills and new materials. Much of the work in the LSC, because it has been individually prescribed, can be completed by the student, independently of the instructor. An instructor, however, is always available in the lab so any student can readily receive any assistance he may need.

As stated above, the curriculum in the LSC consists of reading, writing and math. This study, however, covers only the discipline of math. Math was added to the LSC curriculum in 1976. A comparable study in reading and writing is available in A Three-Year Profile and Evaluation of the Learning Support Center's Reading and English Course, 1974-1976.

Statement of the Problem

The purpose of this study was to describe the demographic characteristics of the Learning Support Center student population who were enrolled in math 179 during the 1976 academic year. In addition to the description of the population, null hypotheses were established to determine relationships or differences between or among specified variables.

Distributions and Hypotheses

Descriptive data by the following categories are presented in this study:

1. Distribution of LSC Math 179 students by sex.
2. Distribution of LSC Math 179 students by age.
3. Distribution of LSC Math 179 students by enrollment status.
4. Distribution of LSC Math 179 students by ethnicity.
5. Distribution of LSC Math 179 students by math pretest scores.
6. Distribution of LSC Math 179 students by math pretest mean scores.

The following null hypotheses were tested.

1. H_o There is no difference among the three major ethnic groups--White Americans, Black Americans, and Hispanics--as measured by the diagnostic math pretest mean scores.
2. H_o There is no difference between contrasted groups as measured by the diagnostic math pretest mean scores: White Americans contrasted with Black Americans, White Americans contrasted with Hispanics, Black Americans contrasted with Hispanics.
3. H_o There is no relationship between cumulative grade point

averages and mathematics pretest scores for students who have earned 12 or more credits.

4. H_o LSC Math 179 grades are independent of mathematics pretest scores.
5. H_o LSC Math 179 grade group (completed-withdrew) is independent of students' sex.
6. H_o LSC Math 179 grade group (completed-withdrew) is independent of students' age.
7. H_o LSC Math 179 grade group (completed-withdrew) is independent of students' enrollment classification.
8. H_o LSC Math 179 grade group (completed-withdrew) is independent of students' ethnic classification.
9. H_o LSC Math 179 grade group (completed-withdrew) is independent of the diagnostic math pretest scores.
10. H_o There is no difference among the three major ethnic groups--White Americans, Black Americans, and Hispanics--as measured by the Math 179 students' diagnostic math test mean change scores.
11. H_o There is no difference between contrasted groups as measured by the diagnostic math test mean change scores: White Americans contrasted with Black Americans, White Americans contrasted with Hispanics, Black Americans contrasted with Hispanics.
12. H_o There is no difference between LSC Math 179 students' diagnostic math pretest mean scores and posttest mean scores.

The .05 level of significance will be used to test all hypotheses.

Data Limitations

The data included in this report are limited to the population of students enrolled in the Learning Support Center's Math 179 classes during the 1976 academic year. Portions of the study which utilize the diagnostic math pretest and posttest scores are delimited to include only those students for whom the specified test scores were available in the research office. The total number of students reported in the tables may vary as a result of demographic data missing from the Student Master Record file or from students who recorded an incorrect student number on the IBM score card or those for whom no test score was located. Grade tables may include students with zero or no available diagnostic math pretest scores.

The data presented are descriptive of the students enrolled in the Learning Support Center's math classes and are not compared with non-Learning Support Center students throughout the college. The data included in Table 8 is an exception in that all students, both LSC and non-LSC, who were tested by the diagnostic math test were included in the computation for the Pearson product-moment correlation coefficients.

Caution should be used in the interpretation of chi-square tests where the expected frequencies in the cells are small. (Siegel, 1956, p. 178).

Homogeneity of variance has been assumed for orthogonal contrasts when the probability level on the Bartlett - Box F test exceeded .05 (Nie, H.H. and others, 1975, p. 426).

Methods And Procedures

Selection of the Subjects

The subjects in this study were restricted to students enrolled in the Learning Support Center's (LSC) Math 179 courses during the 1976 academic year. In the section of this study which pertains to the correlation of the mathematics pretest scores with students' cumulative grade point average, the base population has been expanded to include all students who took the diagnostic math pretest.

Instrumentation

The mathematics test was designed as a cooperative effort between the Learning Support Center, the Mathematics Department and the Nursing Department to identify students who were deficient in arithmetical operations related to addition, subtraction, multiplication, division, fractions, percentages and decimals. The test is composed of 40 items and the administration time is limited to 40 minutes.

Data Collection and Processing

The South Campus research office collected the mathematics test scores for students enrolled in the Math 120 classes and in the introductory nursing classes. The test results were processed by a computer program that indicated incorrect answers and total number of correct items. Initially students who correctly answered no more than one-half of the questions and were enrolled in the Math 120 classes were advised to enroll in the LSC 179 course. Students who

were identified by instructors in higher level mathematics classes and were experiencing difficulty with their assignments were also advised to enroll in the LSC Math 179 course for individual assistance.

Demographic data related to the students included in this study were obtained from the Student Master Record computer files. Math 179 grades were obtained from the Learning Support Center and the mathematics test scores were obtained from the testing office.

Selected statistical tests were performed on these data using computer programs from the Statistical Package for the Social Sciences (Nie, N.H. and others, 1975).

Research Design

Selected demographic variables, mathematics pretest and posttest scores and grades in Math 179 classes, were obtained to establish a profile of the Learning Support Center's mathematics students for the four terms occurring in the 1976 academic year. These characteristics are shown in distribution tables numbers 1 through 6 contained in this study.

Null hypotheses were formulated and are included in the section of the Introduction entitled "Distributions and Hypotheses." Chi-square tests were used to test hypotheses 4, 5, 6, 7, 8 and 9. The one-way analysis of variance was used to test hypotheses 1 and 10 and was followed by orthogonal comparisons to test hypotheses 2 and 11. The t test was applied to hypothesis 12 and the Pearson product-moment correlation was used to test hypothesis number 3.

Results

Sub-study 1 Based on Diagnostic Math Pretest Score Results

Beginning in the Fall term 1976-1, the research office maintained a file of the diagnostic math pretest scores for students taking the test at Miami-Dade Community College--South Campus. The data included in this section of the report is based on those students enrolled in the Math 179 classes for the 1976 academic year and those who had pretest scores available in the research office files. Demographic information was secured from the college's data-based computer files and Math 179 grades were obtained from the Learning Support Center. These data have been used to develop a profile of students enrolled in the LSC Math 179 classes.

Distribution of LSC students by sex. The distribution of LSC math students by sex is shown in Table 1. A larger proportion of females than males were enrolled in Math 179 classes for the 1976-1, 1976-2, and 1976-3 terms. In the 1976-3 term, almost two-thirds of the students were female while slightly more than one-half of the students in the 1976-1 and 1976-2 terms were females. The 1976-4 term was an exception to this pattern in that more than one-half (54.2%) of the students were male.

The enrollment pattern for the 1976 academic year showed that more students enrolled in the winter term than the fall term. While the spring and summer term enrollment was approximately one-half as large as the fall and winter enrollment, the summer enrollment slightly exceeded the spring enrollment.

Table 1

Distribution of LSC Math Students by Sex

	Sex				
	Male		Female		Row Total
Term	N	%[a]	N	%[a]	N
1976-1	124	43.8	159	56.2	283
1976-2	157	43.3	206	56.7	363
1976-3	51	33.8	100	66.2	151
1976-4	90	54.2	76	45.8	166

[a]Row percent.

Table 2

Distribution of LSC Math Students by Age

	Age															
	15 & below		16		17		18		19		20		21		22	
Term	N	%[a]	N	%[a]	N	%[a]	N	%[a]	N	%[a]	N	%[a]	N	%[a]	N	%[a]
1976-1	--	----	--	----	1	.4	19	6.7	40	14.1	43	15.2	32	11.3	28	9.9
1976-2	0	.0	1	.3	4	1.1	27	7.4	46	12.7	52	14.3	34	9.4	20	5.5
1976-3	--	----	1	.7	0	.0	5	3.3	25	16.6	30	19.9	14	9.3	5	3.3
1976-4	3	1.8	0	.0	0	.0	7	4.2	21	12.7	17	10.3	14	8.5	6	3.6

	Age															
	23		24		25		26		27		28		29		30-39	
Term	N	%[a]	N	%[a]	N	%[a]	N	%[a]	N	%[a]	N	%[a]	N	%[a]	N	%[a]
1976-1	19	6.7	12	4.2	8	2.8	4	1.4	5	1.8	11	3.9	5	1.8	33	11.7
1976-2	20	5.5	15	4.1	14	3.9	15	4.1	14	3.9	11	3.0	5	1.4	45	12.4
1976-3	3	2.0	10	6.6	3	2.0	4	2.6	3	2.0	7	4.6	6	4.0	21	13.9
1976-4	13	7.9	6	3.6	4	2.4	5	3.0	6	3.6	15	9.1	15	9.1	19	11.5

[a]Row percent.

Table 2
(continued)

Term	Age							
	40-49		50-59		60-69		Row Total N	Mean Age
	N	%[a]	N	%[a]	N	%[a]		
1976-1	16	5.7	7	2.5	--	----	283	24.3
1976-2	28	7.7	10	2.8	2	.6	363	26.1
1976-3	10	6.6	4	2.6	0	.0	151	25.8
1976-4	8	4.8	5	3.0	1	.6	165	26.1

[a]Row percent.

Distribution of LSC math students by age. The age distribution of the LSC Math 179 students is shown in Table 2. An inspection of the data shows a wide age range of students and the mean age ranges from 24.3 (1976-1 term) to 26.1 (1976-2 and 1976-4).

The mode or largest age group for the four-term period was the 20-year-old students who made up 14.8% of the total population for the 1976 academic year. The 15, 16, and 17 year-old students and students over 59 constituted slightly more than 1% of the total LSC math student enrollment for the year. The second largest group was the 19 year-old students (13.7%). A substantial proportion of the students were in their thirties. When the data for the four terms were combined, the students between 30 and 39 made up 12.3% of the math population. When the combined distribution was dichotomized at age 25, the results showed that thirty-five percent of the students who enrolled in the Math 179 courses in the 1976 academic year were over 25 years old.

The age distributions on a term-by-term basis did not reflect consistent changes in the proportions of students enrolled; however, the proportion of 28 and 29 year-old students had increased and 21 and 22 year-olds had decreased over the four-term period.

Distribution of LSC math students by enrollment status. Table 3 shows the distribution of the Math 179 students by enrollment status. The college's definition of the terminology designating the enrollment classification follows:

First Time refers to a student who is 18 years old or older and who is in attendance at MDCC for the first time.

Transfer refers to a student whose last attendance was a college

or university.

Continuing refers to any student who has been in continuous enrollment more than one term or who has not missed more than four consecutive terms.

Former refers to a student who last attended Miami-Dade Community College more than four terms ago.

High School refers to a student who is concurrently enrolled in high school and who is in attendance at Miami-Dade Community College on a part-time basis.

Approximately three-fourths of the students enrolled in the Math 179 classes were classified as continuing students, while less than one-fifth were first-time-in-college students. The enrollment status classifications combined over the four-term period and arranged in descending proportional order were: continuing students (74.87%), first-time-in-college students (15.99%), former students (5.19%), transfer students (3.22%) and high school students (.73%).

The proportion of students in each category did not vary greatly from term to term; however, there was a substantial decrease of first-time-in-college students enrolled in the spring 1976-3 term as compared to the summer term 1976-4 and a substantial decrease in continuing students during the summer 1976-4 term as compared to the spring term 1976-3.

Distribution of Math 179 students by ethnicity. The distribution of Math 179 students by ethnicity is shown in Table 4. Six categories were identified. Among the three major categories--White Americans, Black Americans and Hispanics--the proportion of White Americans (50.7%) when combined for the four terms was the largest.

Table 3

Distribution of LSC Math Students by Enrollment

	Enrollment Status										
	First time		Transfer		Continuing		Former		High School		Total
Term	N	%[a]	N	%[a]	N	%[a]	N	%[a]	N	%[a]	N
1976-1	55	19.4	8	2.8	209	73.9	11	3.9	0	.0	283
1976-2	55	15.2	14	3.9	267	73.6	25	6.9	2	.6	363
1976-3	10	6.6	2	1.3	133	88.1	5	3.3	1	.7	151
1976-4	34	20.5	7	4.2	112	67.5	9	5.4	4	2.4	166

[a]Row percent.

Table 4

Distribution of LSC Math Students by Ethnicity

Term	Ethnicity												Row total
	White American		Black American		Hispanic		American Indian		Oriental American		Immigrant Alien		
	N	%[a]	N	%[a]	N	%[a]	N	%[a]	N	%[a]	N	%[a]	
1976-1	157	57.9	57	21.0	54	19.9	1	.4	0	.0	2	.7	271
1976-2	176	50.6	98	28.2	74	21.3	0	.0	0	.0	0	.0	348
1976-3	68	46.6	51	34.9	26	17.8	0	.0	1	.7	---	----	146
1976-4	69	42.1	64	39.0	27	16.5	1	.6	3	1.8	---	----	164

[a]Row percent.

Black American students constituted 29.13%, and Hispanics made up approximately one-fifth (19.53%) of the students enrolled in the Math 179 classes.

A trend was evident over the four-term period which showed a decrease in White Americans from 57.9% in the 1976-1 term to 42.1% in the 1976-4 term and a slight decrease in Hispanics from 19.9% in the 1976-1 term to 16.5% in the 1976-4 term. Conversely, the proportion of Black American students increased from 21.0% in the 1976-1 term to 39.0% in the 1976-4 term.

Distribution of LSC math students by the diagnostic math pretest scores. The distribution of LSC Math 179 students by the diagnostic math pretest scores is presented in Table 5. The pretest scores have been collapsed into ten score intervals with raw scores ranging from 1 to a maximum of 40.

In the initial year of the LSC math program, a score of 20 was used by the math department as the recommended cutoff score for referral of Math 120 students to the LSC Math 179 classes. However, when the distribution was dichotomized at 20, approximately two-thirds of the students enrolled in Math 179 scored 20 or less, and approximately one-third scored above 20. On a term-by-term basis the proportion of students scoring 20 or below on the pretest ranged from a low of 64.90% in the 1976-3 term to a high of 68.32% in the 1976-2 term. On a term-by-term basis, no consistent increases or decreases were noted for any score range with the following exceptions: the proportion of students scoring in the 5-8 range decreased from 13.1% in 1976-1 to 9.0% in 1976-4, and the 17-20 range decreased from 15.2% in 1976-1 to 12.0% in 1976-4. Increases and decreases in the other

Table 5

Distribution of LSC Math Students

by the Diagnostic Math Pretest Scores

	Math Pretest Scores																				
	1-4		5-8		9-12		13-16		17-20		21-24		25-28		29-32		33-36		37-40		Row Total
Term	N	%[a]	N	%[a]	N	%[a]	N	%[a]	N	%[a]	N	%[a]	N	%[a]	N	%[a]	N	%[a]	N	%[a]	N
1976-1	7	2.5	37	13.1	54	19.1	52	18.4	43	15.2	33	11.7	31	11.0	14	4.9	12	4.2	0	0.0	283
1976-2	22	6.1	38	10.5	68	18.7	65	17.9	55	15.2	54	14.9	26	7.2	16	4.4	17	4.7	2	.6	363
1976-3	5	3.3	15	9.9	33	21.9	23	15.2	22	14.6	25	16.6	13	8.6	10	6.6	5	3.3	0	.0	151
1976-4	5	3.0	15	9.0	33	19.9	35	21.1	20	12.0	22	13.3	16	9.6	12	7.2	6	3.6	2	1.2	166

[a]Row percent.

score categories were irregular.

Distribution of LSC math students by diagnostic math pretest mean scores. Table 6 shows the number of students and mean pretest scores on the diagnostic math test. The maximum obtainable score was 40. The mean pretest scores for students enrolled in the Math 179 classes ranged from a low of 16.5813 in the 1976-2 term to 17.3494 in the 1976-4 term. Although the increase was modest, less than one point, the pretest mean scores did increase over the four-term period. However, the 1976-1 pretest mean score was slightly higher than the mean score for the 1976-2 term.

Analysis of variance and orthogonal comparisons of ethnicity with diagnostic math pretest scores. A one-way analysis of variance was performed on the data each term for the three major ethnic groups (White Americans, Black Americans, and Hispanics) to test the null hypothesis that there was no significant difference among the three major ethnic groups as measured by the diagnostic math pretest mean scores. The criterion or dependent variable consisted of the pretest total scores and the independent variable consisted of the three major ethnic groups. The analysis of variance was followed by orthogonal comparisons to determine if contrasted groups showed a significant difference. Homogeneity of variance was assumed for the 1976-1, 1976-3, 1976-4 terms and pooled variance estimates were used to determine the t values. Homogeneity of variance was not assumed for the 1976-2 term and separate variance estimates were used to determine the t values. Table 7 shows the results of the analysis of variance, the means, standard deviations, standard errors,

Table 6

Distribution of LSC Math Students by the

Diagnostic Math Pretest Mean Scores

	Mean pretest scores	
	N	Score
1976-1	283	16.9117
1976-2	363	16.5813
1976-3	151	17.2252
1976-4	166	17.3494

Table 7

Analysis of Variance and Orthogonal Comparisons

of Ethnicity With Diagnostic Math

Pretest Scores

Term 76-1

ANOVA: F ratio = 11.413*

Groups	N	Means	Standard Deviation	Standard Error
White	157	18.9172	7.9355	.6333
Black	57	13.7719	7.1189	.9429
Hispanic	54	15.1667	7.5579	1.0285
Total	268	17.0672	7.9889	.4880

t tests

Contrasts	t value[a]	Probability level
White vs. Black	4.324	< .001
White vs. Hispanic	3.090	.002
Black vs. Hispanic	-.955	.341

[a] t value determined by pooled variance estimate.
*p < .001.

Term 76-2

ANOVA: F ratio = 44.595*

Groups	N	Means	Standard Deviation	Standard Error
White	176	20.2102	8.0452	.6064
Black	98	11.8061	6.9899	.7061
Hispanic	74	14.3784	6.3369	.7366
Total	348	16.6034	8.3007	.4450

t tests

Contrasts	t value[a]	Probability level
White vs. Black	9.029	< .001
White vs. Hispanic	6.112	< .001
Black vs. Hispanic	-2.521	.013

[a] t value determined by separate variance estimate.
*p < .001.

Table 7
(continued)
Analysis of Variance and Orthogonal Comparisons

of Ethnicity With Math Pretest Scores

Term 76-3	ANOVA	F ratio = 6.448*			t tests		
Groups	N	Means	Standard Deviation	Standard Error	Contrasts	t value[a]	Probability level
White	68	19.5000	8.3048	1.0071	White vs. Black	3.588	< .001
Black	51	14.3725	7.0199	.9830	White vs. Hispanic	1.103	.272
Hispanic	26	17.5385	7.3877	1.4489	Black vs. Hispanic	-1.703	.091
Total	145	17.3448	8.0003	.6644			

[a] t value determined by pooled variance estimate.
*p < .01.

Term 76-4	ANOVA	F	Means	Standard Deviation	Standard Error	Contrasts	t value[a]	Probability level
White	69	19.8551	8.0060	.9638	White vs. Black	3.805	< .001
Black	64	14.7031	7.5880	.9485	White vs. Hispanic	2.072	.040
Hispanic	27	16.1852	7.7709	1.4955	Black vs. Hispanic	-.828	.409
Total	160	17.1750	8.1144	.6415			

[a] t value determined by pooled variance estimate.
*p < .001.

t values and significant levels for each term. Each of the *F* ratios was highly significant ranging from a probability level of less than .01 (1976-3) to less than .001 (1976-1, 1976-2 and 1976-3). The null hypothesis was rejected and the alternate hypothesis was accepted that there was a significant difference among the three ethnic groups as measured by the diagnostic math pretest mean scores.

The highest diagnostic math pretest mean score (20.21) for White American students occurred in the 1976-2 term and their lowest pretest mean score (18.92) occurred in the 1976-1 term. The highest pretest mean score (14.70) for Black American students occurred in the 1976-4 term and their lowest pretest mean score (11.81) occurred in the 1976-2 term. The Hispanics obtained their highest pretest mean score (17.54) in the 1976-3 term and their lowest pretest mean score (14.38) in the 1976-2 term.

Contrasts were performed on the data for each term for the three major ethnic groups: White Americans with Black Americans, White Americans with Hispanics, and Black Americans with Hispanics.

The null hypothesis that there was no significant difference in diagnostic math pretest mean scores between contrasted groups was tested by the use of the *t* test. The *t* values for the contrasts of White Americans with Black Americans showed that White Americans' pretest mean scores were significantly higher than Black Americans' pretest mean scores ($p < .001$ for each of the four terms). Consequently, the null hypothesis was rejected for this contrast.

The contrast between White Americans and Hispanics showed that the White Americans scored significantly higher than the Hispanics in the 1976-1, 1976-2, and 1976-4 terms (p ranged from less than

.001 to .04) and the corresponding null hypotheses were rejected. The null hypothesis for the 1976-3 term was retained as tenable.

The contrast between the Black Americans and the Hispanics showed no significant difference on the pretest scores except for one of the four terms. The pretest scores for the 1976-2 term showed that the Hispanics scored significantly higher ($p = .013$) than the Black American students. Therefore, the null hypothesis associated with this contrast for the 1976-2 term was rejected, and the null hypotheses for the 1976-1, 1976-3, and 1976-4 terms were retained as tenable.

Correlation of LSC and non-LSC students' cumulative grade point averages with the diagnostic math pretest scores for all students with 12 or more credits. The cumulative grade point average for all students who had taken the diagnostic math test and had earned 12 or more credits was correlated with the math pretest scores. The Pearson product-moment correlation coefficients for the four terms in the 1976 academic year are presented in Table 8. The null hypothesis that cumulative grade point averages were not associated with the diagnostic math pretest scores was rejected as all correlation coefficients were significant ($p \leq .001$). Therefore, the cumulative grade point averages and test scores were associated and the observed r's differed from zero only by chance.

The correlation coefficients ranged from .3093 in the 1976-1 term to .3839 in the 1976-3 term. The lowest correlation coefficient, .3093, represents a common factor variance of .0957 and the highest coefficient, .3839, represents a common factor variance of

Table 8

Correlation of LSC and Non-LSC Students' Cumulative Grade Point Averages With the Diagnostic Math Pretest Scores for All Students With 12 or More Credits

Test Statistics			
Term	N	Pearson Correlation Coefficients	Probability Level
1976-1	501	.3093	.001
1976-2	479	.3428	.001
1976-3	226	.3839	.001
1976-4	129	.3701	.001

.1473. Therefore, the percentage of variance shared by the two variables, diagnostic pretest scores and cumulative grade point average, ranged from 9.57% to 14.73%.

Crosstabulation of LSC Math 179 grades with diagnostic math pretest scores. The diagnostic math pretest scores were crosstabulated with the LSC students' Math 179 grades. Chi-square tests were performed on the data for each term to test the null hypothesis that the two variables, Math 179 grades and diagnostic math pretest scores, were independent. The results of this crosstabulation and chi-square values are presented in Table 9.

The data for all four terms showed a significant relationship between pretest scores and grades received in the Math 179 classes. The data for two of the four terms showed a highly significant relationship at less than the .0001 level (1976-2 and 1976-3) and the data for the two other terms showed a significant relationship at less than the .02 level (1976-1 and 1976-4).

An inspection of the crosstabulations showed that students who scored above 20 were somewhat more likely to receive "A's" with the exception of the 1976-1 term in which 50% of the students who scored 20 or below received "A's". When the "A" grades were combined for all four terms, 41.28% of the "A" grades were assigned to students who scored 20 or below on the pretest.

Students who received "B" grades were more likely to have lower scores on the pretest than the students who received "A's". Over the four-term period approximately three-fourths (72.5%) of the "B" grades were assigned to students who scored 20 or below on the pre-

Table 9

Crosstabulation of LSC Math 179 Grades With Diagnostic

Math Pretest Scores

Term 76-1	Math Pretest Scores																		Row total	
	1-4		5-8		9-12		13-16		17-20		21-24		25-28		29-32		33-36			
Grade	N	%[a]	N	%[a]	N	%[a]	N	%[a]	N	%[a]	N	%[a]	N	%[a]	N	%[a]	N	%[a]	N	%[a]
A	0	.0	2	2.5	9	11.3	16	20.0	13	16.3	13	16.3	15	18.8	6	7.5	6	7.5	80	28.1
B	1	1.2	9	11.5	18	22.0	17	20.7	14	17.1	10	12.2	9	11.0	3	3.7	1	1.2	82	28.8
C	0	.0	8	36.4	10	45.5	2	9.1	2	9.1	0	.0	0	.0	0	.0	0	.0	22	7.7
F	0	.0	1	25.0	1	25.0	1	25.0	1	25.0	0	.0	0	.0	0	.0	0	.0	4	1.4
Incomplete	3	5.6	11	20.4	11	20.4	7	13.0	8	14.8	6	11.1	2	3.7	2	3.7	4	7.4	54	18.9
Withdrew Course	2	5.7	6	17.1	5	14.3	8	22.9	4	11.4	3	8.6	4	11.4	2	5.7	1	2.9	35	12.3
Withdrew College	1	12.5	0	.0	2	25.0	1	12.5	1	12.5	1	12.5	1	12.5	1	12.5	0	.0	8	2.8
Column Total	7	2.5[a]	37	13.0[a]	56	19.6[a]	52	18.2[a]	43	15.1[a]	33	11.6[a]	31	10.9[a]	14	4.9[a]	12	4.2[a]	285	100.0[a]

Note. 153 missing observations.

[a]Row percent.

[b]Column percent.

$\chi^2 = 71.379$, df = 48, $p < .02$.

Table 9
(continued)

Term 76-2	Math Pretest Scores																				Row total	
	1-4		5-8		9-12		13-16		17-20		21-24		25-28		29-32		33-36		37-40			
Grade	N	%[a]	N	%[a]	N	%[a]	N	%[a]	N	%[a]	N	%[a]	N	%[a]	N	%[a]	N	%[a]	N	%[a]	N	%[a]
A	0	.0	0	.0	6	6.8	7	8.0	19	21.6	22	25.0	13	14.8	9	10.2	11	12.5	1	1.1	88	24.2
B	2	2.6	3	3.8	18	23.1	22	28.2	8	10.3	12	15.4	8	10.3	3	3.8	2	2.6	0	.0	78	21.4
C	11	15.7	11	15.7	14	20.0	15	21.4	9	12.9	5	7.1	3	4.3	2	2.9	0	.0	0	.0	70	19.2
D	1	20.0	0	.0	1	20.0	1	20.0	1	20.0	1	20.0	0	.0	0	.0	0	.0	0	.0	5	1.4
F	7	18.9	12	32.4	9	24.3	2	5.4	4	10.8	2	5.4	1	2.7	0	.0	0	.0	0	.0	37	10.2
Incomplete	0	.0	9	17.0	9	17.0	15	28.3	7	13.2	8	15.1	1	1.9	1	1.9	2	3.8	1	1.9	53	14.6
Withdrew Course	1	5.3	0	.0	6	36.6	3	15.8	4	21.1	2	10.5	1	5.3	1	5.3	1	5.3	0	.0	19	5.2
Withdrew College	0	.0	2	14.3	4	28.6	1	7.1	4	28.6	2	14.3	0	.0	0	.0	1	7.1	0	.0	14	3.8
Column Total	22	6.0[a]	37	10.2[a]	67	18.4[a]	66	18.1[a]	56	15.4[a]	54	14.8[a]	27	7.4[a]	16	4.4[a]	17	4.7[a]	2	.5[a]	364	100.0[a]

Note. 76 missing observations.

[a]Row percent.

[b]Column percent.

$\chi^2 = 161.590$, df = 63, $p < .0001$.

Table 9
(continued)

Term 76-3	Math Pretest Scores																					
	1-4		5-8		9-12		13-16		17-20		21-24		25-28		29-32		33-36		37-40		Row total	
Grade	N	%[a]	N	%[a]	N	%[a]	N	%[a]	N	%[a]	N	%[a]	N	%[a]	N	%[a]	N	%[a]	N	%[a]	N	%[a]
A	0	.0	2	4.0	2	4.0	3	6.0	8	16.0	14	28.0	10	20.0	8	16.0	3	6.0	--	---	50	32.7
B	0	.0	6	19.4	13	41.9	5	16.1	2	6.5	3	9.7	1	3.2	1	3.2	0	.0	--	---	31	20.3
C	0	.0	1	6.7	5	33.3	4	26.7	3	20.0	2	13.3	0	.0	0	.0	0	.0	--	---	15	9.8
D	0	.0	0	.0	2	100.0	0	.0	0	.0	0	.0	0	.0	0	.0	0	.0	--	---	2	1.3
F	3	16.7	1	5.6	5	27.8	2	11.1	4	22.2	2	11.1	0	.0	0	.0	1	5.6	--	---	18	11.8
Incomplete	1	5.0	2	10.0	4	20.0	5	25.0	3	15.0	3	15.0	2	10.0	0	.0	0	.0	--	---	20	13.1
Withdrew Course	0	.0	3	25.0	3	25.0	2	16.7	3	25.0	0	.0	0	.0	1	8.3	0	.0	--	---	12	7.8
Withdrew College	1	20.0	0	0.0	0	.0	2	40.0	0	.0	1	20.0	0	.0	0	.0	1	20.0	--	---	5	3.3
Column Total	5	3.3[a]	15	9.8[a]	34	22.2[a]	23	15.0[a]	23	15.0[a]	25	16.3[a]	13	8.5[a]	10	6.5[a]	5	3.3[a]	--	---	153	100.0[a]

Note. 19 missing observations.

[a]Row percent.

[b]Column percent.

$\chi^2 = 100.105$, df = 56, p = .0001.

Table 9
(continued)

Term 76-4	Math Pretest Scores																				Row total	
	1-2		5-8		9-12		13-16		17-20		21-24		25-28		29-32		33-36		37-40			
Grade	N	%[a]	N	%[a]	N	%[a]	N	%[a]	N	%[a]	N	%[a]	N	%[a]	N	%[a]	N	%[a]	N	%[a]	N	%[a]
A	2	3.2	4	6.3	6	9.5	7	11.1	10	15.9	11	17.5	9	14.3	8	12.7	6	9.5	0	.0	63	37.3
B	1	2.0	7	14.3	9	18.4	17	34.7	2	4.1	6	12.2	5	10.2	1	2.0	0	.0	1	2.0	49	29.0
C	2	11.1	2	11.1	4	22.2	4	22.2	3	16.7	1	5.6	1	5.6	1	5.6	0	.0	0	.0	18	10.7
D	0	.0	0	.0	1	14.3	3	42.9	1	14.3	1	14.3	0	.0	1	14.3	0	.0	0	.0	7	4.1
F	0	.0	0	.0	0	.0	0	.0	1	100.0	0	.0	0	.0	0	.0	0	.0	0	.0	1	.6
Incomplete	0	.0	1	4.3	12	52.2	2	8.7	3	13.0	3	13.0	1	4.3	1	4.3	0	.0	0	.0	23	13.6
Withdrew Course	1	12.5	1	12.5	1	12.5	2	25.0	2	25.0	0	.0	0	.0	0	.0	0	.0	1	12.5	8	4.7
Column Total	6	3.6[a]	15	8.9[a]	33	19.5[a]	35	20.7[a]	22	13.0[a]	22	13.0[a]	16	9.5[a]	12	7.1[a]	6	3.6[a]	2	1.2[a]	169	100.0[a]

Note. 31 missing observations.

[a]Row percent.

[b]Column percent.

$\chi^2 = 80.654$, df = 54, $p < .02$.

test.

A combination of grades over the four-term period also showed that "C", "D", "F", "Incomplete", "Withdrawal from Math 179", and "Withdrawal from college" were more likely to be assigned to students with lower scores. Eighty-eight percent of the "C's", 79% of the "D's", 90% of the "F's", 77% of the "Withdrawals from Math 179" and 70% of "Withdrawals from college" were assigned to students scoring 20 or below on the pretest.

However, the combined grade distribution for the four-term period showed that approximately two-thirds of the students received A, B or C grades and only one-third received grades of "D", "F", "Incomplete", "Withdrawal from the Math 179 course", or "Withdrawal from college". The proportional assignments of grades for the 1976 academic year follows: "A" = 28.93%; "B" = 24.72%; "C" = 12.87%; "D" = 1.44%; "F" = 6.18%; "Incomplete" = 15.45%; "Withdrawal from the Math 179 course" = 7.62%; "Withdrawal from the college" = 2.78%.

Math 179 grade group (completed-withdrew) crosstabulated by sex. To determine whether there was a significant relationship between the students' sex and the students' completion or withdrawal from the Math 179 courses, chi-square tests were performed on the data to test the null hypothesis that the two variables, sex and grade group, were independent. The crosstabulations and the results of the chi-square tests for each of the four terms (1976-1, 1976-2, 1976-3 and 1976-4) are shown in Table 10.

For the purpose of this study, the terminology "completed" represents students who received "A" through "D" grades, while the term "withdrew" represents students who withdrew from the Math 179

Table 10

LSC Students Who Completed Math 179

and Those Who Withdrew from Math 179

Crosstabulated by Sex

Term 76-1	Grade Group					
	Completed		Withdrew		Row total	
Sex	N	%[a]	N	%[a]	N	%[a]
Male	106	42.2	25	40.3	131	41.9
Female	145	57.8	37	59.7	182	58.1
Column Total	251	80.2[b]	62	19.8[b]	313	100.0[b]

Note. 125 missing observations.

[a]Column percent.

[b]Row percent.

χ^2 = .017, df = 1, p = .8973.

Term 76-2	Grade Group					
	Completed		Withdrew		Row total	
Sex	N	%[a]	N	%[a]	N	%[a]
Male	112	42.1	9	27.3	121	40.5
Female	154	57.9	24	72.7	178	59.5
Column Total	266	89.0[b]	33	11.0[b]	299	100.0[b]

Note. 141 missing observations.

[a]Column percent.

[b]Row percent.

χ^2 = 2.101, df = 1, p = .1472.

Table 10
(continued)

Term 76-3	Grade Group					
	Completed		Withdrew		Row total	
Sex	N	%[a]	N	%[a]	N	%[a]
Male	41	38.0	5	35.7	46	37.7
Female	67	62.0	9	64.3	76	62.3
Column Total	108	88.5[b]	14	11.5[b]	122	100.0[b]

Note. 50 missing observations.

[a]Column percent.

[b]Row percent.

$\chi^2 = .017$, df = 1, p = .8968.

Term 76-4	Grade Group					
	Completed		Withdrew		Row total	
Sex	N	%[a]	N	%[a]	N	%[a]
Male	73	51.8	26	86.7	99	57.9
Female	68	48.2	4	13.3	72	42.1
Column Total	141	82.5[b]	30	17.5[b]	171	100.0[b]

Note. 29 missing observations.

[a]Column percent.

[b]Row percent.

$\chi^2 = 10.966$, df = 1, $p < .001$.

course. The above definitions apply to Tables 11 through 15. These tables also include students who were enrolled in the Math 179 classes but whose pretest scores were not available to the research office.

The results of the chi-square tests showed that sex was independent of grade group in three of the four terms included in this study. Therefore, for 1976-1, 1976-2, and 1976-3 terms, the null hypothesis was not rejected and it was concluded that the two variables were independent or related only by chance.

However, the results of the chi-square test for the 1976-4 term showed a significant relationship ($p < .001$) between sex and grade group. The null hypothesis for the 1976-4 term was rejected and it was concluded that the two variables were not independent but related. An inspection of the crosstabulation shows that a larger proportion of the withdrawals for the 1976-4 term were male (86.7%) rather than female (13.3%).

Math 179 grade group (completed-withdrew) crosstabulated by age. Chi-square tests were performed for Math 179 students to test the null hypothesis that the variable, grade group, was independent of the variable age. The crosstabulations and chi-square test results are displayed in Table 11.

No significant relationships were found for the 1976-1, 1976-2, and 1976-3 terms. Therefore, the null hypothesis was not rejected and it was concluded that the variable, grade group, was independent or not related to the students' age for students enrolled in the Math 179 courses.

However, the results of the chi-square test were significant ($p < .05$) for the 1976-4 term. An inspection of the data for this

Table 11

LSC Students Who Completed Math 179

and Those Who Withdrew from Math 179

Crosstabulated by Age

Term 76-1	Grade Group					
	Completed		Withdrew		Row total	
Age	N	%[a]	N	%[a]	N	%[a]
17	2	.8	0	.0	2	.6
18	12	4.8	2	3.2	14	4.5
19	36	14.3	7	11.3	43	13.7
20	38	15.1	7	11.3	45	14.4
21	22	8.8	9	14.5	31	9.9
22	20	8.0	8	12.9	28	8.9
23	18	7.2	7	11.3	25	8.0
24	10	4.0	3	4.8	13	4.2
25	7	2.8	3	4.8	10	3.2
26	5	2.0	2	3.2	7	2.2
27	4	1.6	1	1.6	1	1.6
28	9	3.6	1	1.6	1	1.6
29	3	1.2	3	4.8	3	4.8
30-39	32	12.7	9	14.5	9	14.5
40-49	22	8.8	0	.0	0	.0
50-59	8	3.2	0	.0	0	.0
60-69	3	1.2	0	.0	0	.0
Column Total	251	80.2[b]	62	19.8[b]	313	100.0[b]

Note. 125 missing observations.

[a]Column percent.

[b]Row percent.

χ^2 = 19.081, df = 16, p = .2645.

Table 11
(continued)

Term 76-2	Grade Group					
	Completed		Withdrew		Row total	
Age	N	%[a]	N	%[a]	N	%[a]
16	1	.4	0	.0	1	.3
17	3	1.1	2	6.1	5	1.7
18	18	6.8	0	.0	18	6.0
19	27	10.2	5	15.2	32	10.7
20	34	12.8	6	18.2	40	13.4
21	25	9.4	5	15.2	30	10.0
22	14	5.3	2	6.1	16	5.4
23	11	4.1	3	9.1	14	4.7
24	11	4.1	3	9.1	14	4.7
25	9	3.4	0	.0	9	3.0
26	10	3.8	1	3.0	11	3.7
27	14	5.3	1	3.0	15	5.0
28	4	1.5	1	3.0	5	1.7
29	4	1.5	0	.0	4	1.3
30-39	42	15.8	1	3.0	43	14.4
40-49	28	10.5	3	9.1	31	10.4
50-59	10	3.8	0	.0	10	3.3
60-69	1	.4	0	.0	1	.3
Column Total	266	89.0[b]	33	11.0[b]	299	100.0[b]

Note. 141 missing observations.

[a]Column percent.

[b]Row percent.

χ^2 = 19.14012, df = 17, p = .3206.

Table 11
(continued)

Term 76-3	Grade Group					
	Completed		Withdrew		Row total	
Age	N	%[a]	N	%[a]	N	%[a]
16	0	.0	1	7.1	1	.8
18	5	4.6	0	.0	5	4.1
19	17	15.7	2	14.3	19	15.6
20	25	23.1	3	21.4	28	23.0
21	7	6.5	2	14.3	9	7.4
22	5	4.6	0	.0	5	4.1
23	4	3.7	1	7.1	5	4.1
24	4	3.7	2	14.3	6	4.9
25	2	1.9	1	7.1	3	2.5
26	3	2.8	0	.0	3	2.5
27	3	2.8	0	.0	3	2.5
28	4	3.7	2	14.3	6	4.9
29	5	4.6	0	.0	5	4.1
30-39	12	11.1	0	.0	12	9.8
40-49	9	8.3	0	.0	9	7.4
50-59	3	2.8	0	.0	3	2.5
Column Total	108	88.5[b]	14	11.5[b]	122	100.0[b]

Note. 50 missing observations.

[a]Column percent.

[b]Row percent.

$\chi^2 = 22.016$, df = 15, p = .1074.

Table 11
(continued)

Term 76-4	Grade Group					
	Completed		Withdrew		Row total	
Age	N	%[a]	N	%[a]	N	%[a]
15	3	2.1	1	3.3	4	2.4
18	8	5.7	0	.0	8	4.7
19	18	12.9	2	6.7	20	11.8
20	10	7.1	1	3.3	11	6.5
21	11	7.9	1	3.3	12	7.1
22	5	3.6	0	0.0	5	2.9
23	10	7.1	3	10.0	13	7.6
24	5	3.6	4	13.3	9	5.3
25	4	2.9	2	6.7	6	3.5
26	4	2.9	4	13.3	8	4.7
27	5	3.6	2	6.7	7	4.1
28	15	10.7	1	3.3	16	9.4
29	14	10.0	0	.0	14	8.2
30-39	14	10.0	7	23.3	21	12.4
40-49	8	5.7	2	6.7	10	5.9
50-59	5	3.6	0	.0	5	2.9
60-69	1	.7	0	.0	1	.6
Column Total	140	82.4[b]	30	17.6[b]	170	100.0[b]

Note. 30 missing observations.

[a]Column percent.

[b]Row percent.

$\chi^2 = 26.382$, $df = 16$, $p < .05$.

term shows that a slightly larger proportion of the students who withdrew were over 25 years old (53.3%), while a slightly higher proportion of completers were 25 years old or under (52.9%). Therefore, the null hypothesis was rejected and it was concluded that age and grade group were related for the students enrolled in the Math 179 courses during the 1976-4 term.

Math 179 grade group (completed-withdrew) crosstabulated by enrollment status. Chi-square tests for Math 179 students were performed to test the null hypothesis that students' enrollment status was independent of the students' grade group. The results of these data are reported in Table 12. The definitions for the enrollment categories have been explained in the discussion related to Table 3.

The null hypothesis was rejected for the 1976-1 term and 1976-4 term, and it was concluded that the two variables, enrollment status and grade group, were not independent but related. An inspection of data for these terms showed that a larger proportion of the withdrawals were first-time-in-college students, and a larger proportion of the completers were continuing students.

The chi-square values for the 1976-2 and 1976-3 terms were not significant; therefore, the null hypothesis that enrollment status and grade group were independent was retained as tenable.

Math 179 grade group (completed-withdrew) crosstabulated by ethnicity. The null hypothesis was tested that the variable, grade group, was independent of ethnicity for students enrolled in the Math 179 courses. The ethnic classification included three major groups--White Americans, Black Americans, and Hispanics--and three

Table 12

LSC Students Who Completed Math 179

and Those Who Withdrew from Math 179

Crosstabulated by Enrollment Status

Term 76-1	Grade Group					
	Completed		Withdrew		Row total	
Enrollment Status	N	%[a]	N	%[a]	N	%[a]
First time	36	14.3	18	29.0	54	17.3
Transfer	6	2.4	0	.0	6	1.9
Continuing	201	80.1	41	66.1	242	77.3
Former	7	2.8	3	4.8	10	3.2
High School	1	.4	0	.0	1	.3
Column Total	251	80.2[b]	62	19.8[b]	313	100.0[b]

Note. 125 missing observations.

[a]Column percent.

[b]Row percent.

$\chi^2 = 9.853$, df = 4, $p < .05$.

Term 76-2	Grade Group					
	Completed		Withdrew		Row total	
Enrollment Status	N	%[a]	N	%[a]	N	%[a]
First time	33	12.4	3	9.1	36	12.0
Transfer	10	3.8	2	6.1	12	4.0
Continuing	207	77.8	26	78.8	233	77.9
Former	14	5.3	2	6.1	16	5.4
High School	2	.8	0	.0	2	.7
Column Total	266	89.0[b]	33	11.0[b]	299	100.0[b]

Note. 141 missing observations.

[a]Column percent.

[b]Row percent.

$\chi^2 = .942$, df = 4, $p = .9185$.

Table 12
(continued)

Term 76-3	Grade Group					
	Completed		Withdrew		Row total	
Enrollment Status	N	%[a]	N	%[a]	N	%[a]
First time	6	5.6	1	7.1	7	5.7
Transfer	3	2.8	0	.0	3	2.5
Continuing	95	88.0	12	85.7	107	87.7
Former	3	2.8	0	.0	3	2.5
High School	1	.9	1	7.1	2	1.6
Column Total	108	88.5[b]	14	11.5[b]	122	100.0[b]

Note. 50 missing observations.

[a]Column percent.

[b]Row percent.

$\chi^2 = 3.761$, df = 4, p = .4393.

Term 76-4	Grade Group					
	Completed		Withdrew		Row total	
Enrollment Status	N	%[a]	N	%[a]	N	%[a]
First time	34	24.1	13	43.3	47	27.5
Transfer	7	5.0	4	13.3	11	6.4
Continuing	91	64.5	9	30.0	100	58.5
Former	6	4.3	3	10.0	9	5.3
High School	3	2.1	1	3.3	4	2.3
Column Total	141	82.5[b]	30	17.5[b]	171	100.0[b]

Note. 29 missing observations.

[a]Column percent.

[b]Row percent.

$\chi^2 = 12.769$, df = 29, $p < .02$.

Table 13

LSC Students Who Completed Math 179

and Those Who Withdrew from Math 179

Crosstabulated by Ethnicity

Term 76-1	Grade Group					
	Completed		Withdrew		Row total	
Ethnicity	N	%[a]	N	%[a]	N	%[a]
White American	133	56.4	30	49.2	163	54.9
Black American	53	22.5	18	29.5	71	23.9
Hispanic	49	20.8	11	18.0	60	20.2
American Indian	1	.4	0	.0	1	.3
Immigrant Alien	0	.0	1	1.6	1	.3
Student Visa	0	.0	1	1.6	1	.3
Column Total	236	79.5[b]	61	20.5[b]	297	100.0[b]

Note. 141 missing observations.

[a]Column percent.

[b]Row percent.

$\chi^2 = 9.638$, df = 5, p = .0862.

Term 76-2	Grade Group					
	Completed		Withdrew		Row total	
Ethnicity	N	%[a]	N	%[a]	N	%[a]
White American	134	53.6	18	54.5	152	53.7
Black American	60	24.0	8	24.2	68	24.0
Hispanic	56	22.4	7	21.2	63	22.3
Column Total	250	88.3[b]	33	11.7[b]	283	100.0[b]

Note. 157 missing observations.

[a]Column percent.

[b]Row percent.

$\chi^2 = .024$, df = 2, p = .9881.

Table 13
(continued)

Term 76-3	Grade Group					
	Completed		Withdrew		Row total	
Ethnicity	N	%[a]	N	%[a]	N	%[a]
White American	55	52.4	5	35.7	60	50.4
Black American	36	34.3	7	50.0	43	36.1
Hispanic	13	12.4	2	14.3	15	12.6
Oriental American	1	1.0	0	.0	1	.8
Column Total	105	88.2[b]	14	11.8[b]	119	100.0[b]

Note. 53 missing observations.

[a]Column percent.

[b]Row percent.

$\chi^2 = 1.694$, df = 3, p = .6384.

Term 76-4	Grade Group					
	Completed		Withdrew		Row total	
Ethnicity	N	%[a]	N	%[a]	N	%[a]
White American	55	39.3	17	58.6	72	42.6
Black American	59	42.1	9	31.0	68	40.2
Hispanic	22	15.7	2	6.9	24	14.2
American Indian	1	.7	0	.0	1	.6
Oriental American	3	2.1	1	3.4	4	2.4
Column Total	140	82.8[b]	29	17.2[b]	169	100.0[b]

Note. 31 missing observations.

[a]Column percent.

[b]Row percent.

$\chi^2 = 4.540$, df = 4, p = .3378.

minor classifications--American Indians, Oriental Americans, and Immigrant Aliens.

Chi-square tests were performed on the Math 179 data for each of the four terms in the 1976 academic year. The crosstabulations of the data and results of the tests are shown in Table 13. None of the tests yielded a significant chi-square value at the .05 level of significance. Therefore, the null hypothesis was not rejected and it was concluded that completion of withdrawal from Math 179 courses was independent or not related to the ethnic classification of the students enrolled.

Math 179 grade group (completed-withdrew) crosstabulated by diagnostic math pretest scores. The null hypothesis was established to determine if the variable, grade group, was independent of the Math 179 students' diagnostic math pretest scores. The scores were partitioned into 10 score intervals with raw scores ranging from 1 to 40.

The crosstabulations and chi-square results are presented by academic term in Table 14. None of the chi-square tests for the four terms yielded a significant chi-square value at the .05 level. Therefore, the null hypothesis was not rejected and it was concluded that completion or withdrawal from Math 179 classes was not significantly related to the diagnostic math pretest scores.

Further inspection of the data shows that the proportion of students who completed the ath 179 courses with letter grades of A, B, C, and D ranged from 84% in the 1976-1 term to 94.5% in the 1976-4 term. The percentage of students who withdrew from the Math 179 courses ranged from 16% in 1976-1 term to 5.5% in the 1976-4 term.

Table 14

LSC Students Who Completed Math 179
and Those Who Withdrew from Math 179
Crosstabulated by Diagnostic Math Pretest
Scores

Term 76-1	Grade Group					
	Completed		Withdrew		Row total	
Math Pretest Scores	N	%[a]	N	%[a]	N	%[a]
1-4	1	.5	2	5.7	3	1.4
5-8	19	10.3	6	17.1	25	11.4
9-12	37	20.1	5	14.3	42	19.2
13-16	35	19.0	8	22.9	43	19.6
17-20	29	15.8	4	11.4	33	15.1
21-24	23	12.5	3	8.6	26	11.9
25-28	24	13.0	4	11.4	28	12.8
29-32	9	4.9	2	5.7	11	5.0
33-36	7	3.8	1	2.9	8	3.7
Column Total	184	84.0[b]	35	16.0[b]	219	100.0[b]

Note. 219 missing observations.

[a]Column percent.

[b]Row percent.

$\chi^2 = 8.597$, df = 8, p = .3774.

Table 14
(continued)

Term 76-2	Grade Group					
	Completed		Withdrew		Row total	
Math Pretest Scores	N	%[a]	N	%[a]	N	%[a]
1-4	14	5.8	1	5.3	15	5.8
5-8	14	5.8	0	.0	14	5.4
9-12	39	16.2	6	31.6	45	17.3
13-16	45	18.7	3	15.8	48	18.5
17-20	37	15.4	4	21.1	41	15.8
21-24	40	16.6	2	10.5	42	16.2
25-28	24	10.0	1	5.3	25	9.6
29-32	14	5.8	1	5.3	15	5.8
33-36	13	5.4	1	5.3	14	5.4
37-40	1	.4	0	.0	1	.4
Column Total	241	92.7[b]	19	7.3[b]	260	100.0[b]

Note. 180 missing observations.

[a]Column percent.

[b]Row percent.

$\chi^2 = 4.861$, df = 9, p = .8462.

Table 14
(continued)

Term 76-3	Grade Group					
	Completed		Withdrew		Row total	
Math Pretest Scores	N	%[a]	N	%[a]	N	%[a]
5-8	9	9.2	3	25.0	12	10.9
9-12	22	22.4	3	25.0	25	22.7
13-16	12	12.2	2	16.7	14	12.7
17-20	13	13.3	3	25.0	16	14.5
21-24	19	19.4	0	.0	19	17.3
25-28	11	11.2	0	.0	11	10.0
29-32	9	9.2	1	8.3	10	9.1
33-36	3	3.1	0	.0	3	2.7
Column Total	98	89.1[b]	12	10.9[b]	110	100.0[b]

Note. 62 missing observations.

[a]Column percent.

[b]Row percent.

$\chi^2 = 7.708$, df = 7, p = .3591.

Table 14
(continued)

Term 76-4	Grade Group					
	Completed		Withdrew		Row total	
Math Pretest Scores	N	%[a]	N	%[a]	N	%[a]
1-4	5	3.6	1	12.5	6	4.1
5-8	13	9.5	1	12.5	14	9.7
9-12	20	14.6	1	12.5	21	14.5
13-16	31	22.6	2	25.0	33	22.8
17-20	16	11.7	2	25.0	18	12.4
21-24	19	13.9	0	.0	19	13.1
25-28	15	10.9	0	.0	15	10.3
29-32	11	8.0	0	.0	11	7.6
33-36	6	4.4	0	.0	6	4.1
37-40	1	.7	1	12.5	2	1.4
Column Total	137	94.5[b]	8	5.5[b]	145	100.0[b]

Note. 55 missing observations.

[a]Column percent.

[b]Row percent.

$\chi^2 = 13.194$, df = 9, p = .1540.

Sub-study 2 Based on Diagnostic Math Pre-Posttest Total Change Scores

The math posttest was administered at the end of each term to students enrolled in the LSC Math 179 courses. The term "change score" refers to the difference between the diagnostic math pretest and posttest scores. The population in this section of the report consists of LSC Math 179 students who received A, B, C, D and F letter grades.

Analysis of variance and orthogonal comparisons of ethnicity with diagnostic math pretest to posttest change scores. A one-way analysis of variance was used to test the null hypothesis that there was no significant difference in the change scores among the three major ethnic groups enrolled in LSC Math 179 classes. The criterion or dependent variable consisted of the diagnostic math test change scores and the independent variable, ethnicity, represented the three major groups--White Americans, Black Americans, and Hispanics. The F test was followed by orthogonal comparisons to determine if the differences between contrasted groups were significant. Homogeneity of variance was assumed for all of the orthogonal contrasts and pooled variance estimates were used to determine t values.

The F ratios, change score means, standard deviations, standard errors, and the results of t tests contrasts are shown in Table 15. The F ratios for three of the four terms were significant (1976-1, 1976-2, 1976-3). Therefore, for these three terms the null hypothesis was rejected and it was concluded that there was a significant difference among White Americans, Black Americans and Hispanics as mea-

sured by the diagnostic math test change scores. The null hypothesis for the 1976-4 term was not rejected and it was concluded there were no significant differences among the change scores for the three ethnic groups during the 1976-4 term.

An inspection of the data in Table 15 shows that mean change scores for White Americans enrolled in Math 179 ranged from 5.973 (1976-2) to 8.1705 (1976-1). The mean change scores for Black Americans ranged from 2.7407 (1976-3) to 4.5517 (1976-1), and the mean change scores for Hispanics ranged from 4.4545 (1976-3) to 7.200 (1976-4). When all the scores were combined, the highest total mean change score, 7.0850, occurred in the 1976-1 term and the lowest total mean change score, 4.8861, occurred in the 1976-3 term. The mean change scores for each major ethnic classification were averaged over the four terms in the 1976 academic year. The results of the averaging of the change scores showed that White American students had increased their scores by 6.80 points, the Black Americans by 3.98 points, and the Hispanics by 6.47 points.

The null hypothesis that there was no significant difference in the mean change scores was tested by the t test which was performed on the data for each of the following groups: White Americans contrasted with Black Americans, White Americans contrasted with Hispanics and Black Americans with Hispanics. The contrasts were performed for each of the 4 terms. In the 1976-1 term the contrast between White Americans and Black Americans showed that the White students had significantly larger change scores than the Blacks ($p = .004$). In the 1976-2 term the contrast between Black Americans and Hispanics showed that the Hispanic students had significantly

Table 15

Analysis of Variance and Orthogonal Comparisons

of Ethnicity With Diagnostic Math Pretest-Posttest

Change Scores

Term 76-1	ANOVA - F ratio = 4.540*					t tests		
	Groups	N	Change Score Means	Standard Deviation	Standard Error	Contrasts	t value[a]	Probability Level
	White	88	8.1705	5.9870	.6382	White vs. Black	2.912	.004
	Black	29	4.5517	6.2882	1.1677	White vs. Hispanic	1.498	.136
	Hispanic	32	6.3750	4.7298	.8361	Black vs. Hispanic	-1.225	.222
	Total	149	7.0850	5.9417	.4868			

[a] t value determined by pooled variance estimate.

* $p < .02$.

Table 15
(continued)

Term 76-2	ANOVA - F ratio = 3.656*				t tests		
	Groups	N	Change Score Means	Standard Deviation	Standard Error	Contrasts	t value[a]	Probability Level
	White	111	5.9730	6.5303	.6198	White vs. Black	1.752	.081
	Black	50	4.1200	5.8227	.8235	White vs. Hispanic	-1.464	.145
	Hispanic	41	7.8515	5.7391	.8963	Black vs. Hispanic	-2.687	.008
	Total	202	5.8515	6.2897	.4425			

[a] t value determined by pooled variance estimate.

* p < .03.

71

72

Table 15
(continued)

Term 76-3	ANOVA - F ratio = 4.716*					t tests	
	Groups	N	Change Score Means	Standard Deviation	Standard Error	Contrasts	t value[a]	Probability Level
	White	41	6.4146	5.0148	.7832	White vs. Black	3.055	.003
	Black	27	2.7407	4.6541	.8957	White vs. Hispanic	1.189	.238
	Hispanic	11	4.4545	4.6982	1.4165	Black vs. Hispanic	-.987	.327
	Total	79	4.8861	5.0788	.5714			

[a] t value determined by pooled variance estimate.

* $p < .02$

Table 15
(continued)

Term 76-4	ANOVA - F ratio = 2.329*				t tests		
	Groups	N	Change Score Means	Standard Deviation	Standard Error	Contrasts	t value[a]	Probability Level
	White	53	6.6604	5.8076	.7977	White vs. Black	1.846	.067
	Black	57	4.5263	6.0801	.8053	White vs. Hispanic	- .339	.735
	Hispanic	20	7.2000	6.6301	1.4825	Black vs. Hispanic	-1.698	.092
	Total	130	5.8077	6.1191	.5367			

[a] t value determined by pooled variance estimate.

* p = .1015.

larger change scores than the Blacks ($p = .008$), and in the 1976-3 term the contrast between White Americans and Black Americans again showed that the White students had larger change scores than the Blacks ($p = .003$). For these contrasts the null hypothesis was rejected and it was concluded that the diagnostic math mean change scores were significantly different for these specific groups during the 1976-1, 1976-2 and 1976-3 terms. However, the majority of the contrasts (9 out of the 12 contrasts) showed no significant difference in the mean change scores. The contrasts for which the null hypothesis was held tenable included Whites contrasted with Hispanics in the 1976-1, 1976-2, 1976-3 and 1976-4 terms; Black Americans contrasted with Hispanics in the 1976-1, 1976-3 and 1976-4 terms; and White Americans contrasted with Black Americans in the 1976-2 and the 1976-4 terms. It is also noted that none of the contrasts in the 1976-4 term were significant at the .05 level.

LSC Math 179 students' diagnostic math pretest-posttest mean scores and t tests. The null hypothesis was established to determine if there was a significant difference between mean pretest and mean posttest diagnostic math scores for students completing the LSC Math 179 course. The t test was used to test the null hypothesis that there was no significant difference in pretest and posttest scores, and the statistical data pertaining to each term is shown in Table 16. The population includes all students who completed the Math 179 classes.

The data in Table 16 show that positive changes occurred each term and these changes were highly significant ($p < .001$). Therefore, the null hypothesis was rejected and it was concluded that

the posttest mean scores were significantly higher than the pretest mean scores.

An inspection of the data shows that the pretest mean scores ranged from 17.25 (1976-1) to 18.59 (1976-3). The posttest mean scores ranged from 23.25 (1976-2) to 24.36 (1976-1). The largest net change, 7.1019, occurred in the 1976-1 term.

Table 16

LSC Math 179 Students' Diagnostic Math

Pretest-Posttest Mean Scores and *t* Tests

Term 76-1	Test Statistics					
Test Component	N	Mean Score	Standard Deviation	Standard Error	*t* value[a]	Two-tailed Probability
Pretest	157	17.2548	7.391	.590		
Posttest	157	24.3567	7.903	.631		
Difference	157	7.1019	5.992	.478	14.85	$< .001$

[a] *df* = 156.

Term 76-2	Test Statistics					
Test Component	N	Mean Score	Standard Deviation	Standard Error	*t* value[a]	Two-tailed Probability
Pretest	214	17.5514	7.988	.546		
Posttest	214	23.2523	8.653	.592		
Difference	214	5.7009	6.650	.455	12.54	$< .001$

[a] *df* = 213.

Table 16
(continued)

Term 76-3	Test Statistics					
Test Component	N	Mean Score	Standard Deviation	Standard Error	t value[a]	Two-tailed Probability
Pretest	83	18.5903	7.865	.863		
Posttest	83	23.6024	8.326	.914		
Difference	83	5.0121	5.107	.561	8.94	$< .001$

[a] $df = 82$.

Term 76-4	Test Statistics					
Test Component	N	Mean Score	Standard Deviation	Standard Error	t value[a]	Two-tailed Probability
Pretest	135	17.7630	8.310	.715		
Posttest	135	23.5481	8.637	.743		
Difference	135	5.7852	6.147	.529	10.94	$< .001$

[a] $df = 134$.

Summary, Implications, Recommendations, and Conclusions

Within the limits of the data in this study, the following conclusions, implications, and recommendations were reached:

1. Distribution of LSC Math Students by Sex

Generally a larger proportion of female students (slightly more than one-half to two-thirds) than male students enrolled in the LSC math classes during the 1976 academic year. However, in the summer term (1976-4) more than one-half of the students were male.

Since the 1976 academic year was the first year for the LSC math program, the sexual distribution of students may not be representative of future terms. However, the demographic data may be useful for planning and assuring that instructional materials and strategies are free from any sexual bias.

2. Distribution of LSC Math Students by Age

There was a wide age distribution of students enrolled in the LSC math courses during the 1976 academic year. The ages ranged from 15 and below to 69 and the mean age ranged from 24.3 to 26.1. On a combined four-term basis, 35% of the students enrolled in the LSC math courses were over 25 years old. During the 1976 academic year the 19 and 20 year-old students constituted the largest proportion of the LSC math population; however, on a term-by-term basis the proportion of 21 and 22 year-olds decreased and the proportion of 28 and 29 year-old students increased.

The findings imply that materials selected for use in the LSC must

be designed to appeal to the interest of the mature student regardless of the achievement level of the student. It also implies that instructors in the LSC must be aware of the age range of the students when selecting teaching strategies to be used in the Learning Support Center.

3. Distribution of LSC Math Students by Enrollment Status

The students were classified into five enrollment groups: first-time-in-college, transfer, continuing, former, and high school students.

Over the four-term period, approximately three-fourths of the students enrolled in the LSC math classes were continuing students and less than one-fifth were first-time-in-college students. The proportion of students in these two categories did fluctuate in the spring and summer terms with a substantial increase in first-time-in-college students during the summer term and a decrease in proportion of continuing students in the summer term 1976-4.

These findings imply that as students continue in college they become more aware of their academic deficiencies and more responsive to the academic assistance offered in the LSC. It is recommended that a recruitment effort be made to attract first-time-in-college students to the LSC as soon as possible so they can benefit from this service early in their college experience.

4. Distribution of LSC Math Students by Ethnicity

The ethnic classification of the LSC math students was divided into six categories with the three major categories being: White Americans, Black Americans and Hispanics. When the enrollment for the four terms was combined, 50.7% were White Americans, 29.13% Black Americans and 19.53% Hispanics. During the 1976 academic year the proportion

of White Americans decreased from 57.9% (1976-1) to 42.1% (1976-4); Black Americans increased from 21.0% (1976-1) to 39.0% (1976-4); and Hispanics decreased from 19.9% (1976-1) to 16.5% (1976-4).

These findings imply that the LSC staff should continue to seek out materials which are applicable to students from diverse cultural backgrounds.

5. Distribution of LSC Math Students by Diagnostic Math Pretest Scores

The diagnostic math test, which consisted of an established maximum score of 40, was collapsed into ten four-score intervals. Although in the initial year of the LSC math program the mathematics Department recommended that students enrolled in Math 120 courses with a score of 20 or less concurrently enroll in the LSC Math 179, approximately one-third of the students enrolled in Math 179 scored above 20 on the pretest. On a term-by-term basis the proportion of students scoring 20 or below on the pretest ranged from 64.90% (1976-3) to 68.32% (1976-2). The data showed that the raw scores ranged from one to forty.

These findings imply that the Learning Support Center has attracted a heterogeneous group of students and functions as a developmental program rather than a remedial program. It also implies the need for multi-level materials in the Center.

6. Distribution of LSC Math Students by Diagnostic Math Pretest Mean Scores

The diagnostic math pretest mean scores of students enrolled in the LSC math classes ranged from a low of 16.5813 in the 1976-2 term to a high of 17.3494 in the 1976-4 term. The pretest mean scores reflect a slight increase in scores during the last two terms of the

academic year.

The slightly higher pretest mean scores may indicate that the program is attracting higher scoring students. This is important since the math program is developmental rather than remedial. The program is designed to meet the math needs of any student from basic arithmetic through calculus.

7. Analysis of Variance and Orthogonal Comparisons of Ethnicity with Diagnostic Math Pretest Scores

A one-way analysis of variance was performed on the data each term to test the null hypothesis that there was no significant difference among the three major ethnic groups (White Americans, Black Americans and Hispanics) as measured by the diagnostic math pretest mean scores. Each of the tests were significant (p ranged from .01 to .001); therefore, the null hypothesis was rejected and it was concluded that there was a significant difference among the three major ethnic groups as measured by the diagnostic math pretest mean scores.

Contrasts were performed each term on the three major groups: White Americans with Black Americans, White Americans with Hispanics and Black Americans with Hispanics. Pretest mean scores for White American students were found to be significantly higher ($p < .001$) than for Black American students in each of the four terms. White Americans scored significantly higher ($p \leq .04$) than Hispanics in three of the four terms (1976-1, 1976-2 and 1976-4). The Hispanic students were found not to score significantly higher than the Black American students in three of the four terms (1976-1, 1976-3 and 1976-4).

These results imply that the staff of the LSC Math lab should be aware of these differences and make an effort at the time of returning

test scores to recruit the lower scoring math student particularly among the Black and Hispanic student population.

8. Correlation of LSC and Non-LSC Students' Cumulative Grade Point Averages with the Diagnostic Math Pretest Scores for All Students with 12 or More Credits

Pearson product-moment correlation coefficients were computed to test the null hypothesis that there was no relationship between cumulative grade point averages and the diagnostic math pretest scores. All students who had taken the diagnostic math test and had earned 12 or more credits were included in the computation. Although the coefficients were relatively low, ranging from .3093 to .3839, all of the relationships were significant at the .001 level. The correlation coefficients showed that the percentage of shared common factor variance ranged from approximately 10% to 15%.

These findings show a consistent positive relationship between grade point averages and pretest diagnostic math scores and imply that generally more academically inclined students do better on the pretest. The diagnostic math pretest scores, therefore, may have some predictive validity for students enrolled at Miami-Dade.

9. Crosstabulation of LSC Math 179 Grades with Diagnostic Math Pretest Scores

Chi-square tests were performed on the data for each term to test the null hypothesis that the two variables, Math 179 grades and diagnostic math pretest scores, were independent. The relationship between LSC Math 179 grades and pretest scores was significant for each of the four terms (p ranged from less than .02 to less than .0001).

Students who scored above 20 were somewhat more likely to receive A's (about 59%) than students who scored 20 or below. Over the four-term period approximately 29% of all the grades assigned were A's.

Students who scored 20 or below were much more likely to receive grades of B, C, D, F, withdrawals from math, and withdrawals from college than students who scored above 20. The combined distribution of grades for the entire academic year showed that approximately two-thirds of the students who enrolled in LSC math classes received A, B, or C grades. Only a small percentage (6.18%) of the grades were F.

These findings imply that the staff of the Learning Center be alerted to the fact that if the math program in the LSC is totally individualized, all students have an equal opportunity for a final grade of "A" regardless of their pretest score on the Diagnostic Math Test. The staff needs to be aware of the fact that students below the score of 20 need additional assistance and encouragement to get the most out of the program offered by the Learning Support Center. It is recommended that a special effort be made to ascertain why students do not complete the math course or withdraw from the math course.

10. Math 179 Grade Group (Completed-Withdrew) Crosstabulated by Sex

Chi-square tests were performed to test the null hypothesis that completion or withdrawal from the Math 179 classes was independent of sex. None of the data for the four terms showed a significant relationship between these variables and it was generally concluded that sex was not a factor in determining whether a student completed or withdrew from the LSC math classes.

The findings indicate that the staff of the LSC math lab has been successful in eliminating sex bias in dealing with Math 179 students.

11. Math 179 Grade Group (Completed-Withdrew) Crosstabulated by Age

Chi-square tests were performed to test the null hypothesis that completion or withdrawal from the Math 179 classes was independent of age. The data for three (1976-1, 1976-2, 1976-3) of the four terms showed no significant relationship and it was generally concluded that age was not a factor in determining whether a student completed or withdrew from the LSC math classes.

However, the results of the chi-square test for the 1976-4 term were significant ($p < .05$) and the data for this term showed that a slightly larger proportion of students who withdrew were over 25 years old and a slightly larger proportion of the completers were 25 or under.

The results imply that the materials and strategies used in the math lab were generally effective for the broad range of ages represented in the LSC. The results of the study imply that particular attention should be paid to the materials and strategies used with the more mature student.

12. Math 179 Grade Group (Completed-Withdrew) Crosstabulated by Enrollment Status

Chi-square tests were performed to test the null hypothesis that completion or withdrawal from the Math 179 classes was independent of enrollment status. The data for the 1976-2 and 1976-3 terms did not show a significant relationship between grade group (completed-withdrew) and enrollment status. However, the chi-square tests for the 1976-1 and 1976-4 terms were significant ($p < .05$) and it was concluded that during these two terms the variables, grade group and enrollment status, were related. The data for the 1976-1 and 1976-4 terms showed that first-time-in-college students were more likely to withdraw than com-

plete the course and continuing students were more likely to complete the course than withdraw.

Although the findings were not consistent from term-to-term, these data imply that special attention needs to be given to first-time-in-college math students. Through the computerized enrollment system used in the LSC, the staff is alerted to a lack of attendance by these students. Through the completion or lack of completion of objectives as indicated on the student folder, the staff is alerted to the students' progress. These two program components need to be closely monitered for the first-time-in-college math student. A student deficient in either component should be personally contacted by the staff of the LSC and be encouraged to complete the math program.

13. Math 179 Grade Group (Completed-Withdrew) Crosstabulated by Ethnicity

Chi-square tests were performed to test the null hypothesis that completion or withdrawal from the Math 179 classes was independent of ethnic classification. None of the chi-square values for the four terms showed a significant relationship, and it was concluded that ethnic classification was not a factor in determining whether a student completed or withdrew from LSC math classes.

These results show that the staff of the math lab was successful in enabling students from various ethnic backgrounds to complete their Math 179 course despite data which showed some significant differences among the groups in pretest scores and grades achieved.

14. Math 179 Grade Group (Completed-Withdrew) Crosstabulated by Diagnostic Math Pretest Scores

Chi-square tests were performed to test the null hypothesis that

completion or withdrawal from the Math 179 classes was independent of the students' diagnostic math pretest scores. None of the chi-square values for the four terms showed a significant relationship, and it was concluded that the students' pretest scores were not a factor in determining whether a student completed or withdrew from the LSC math classes. An inspection of the data showed that the proportion of students who received A, B, C, or D grades increased over the four-term period and, conversely, the proportion of withdrawals from the Math 179 classes steadily decreased over the period.

These data seem to indicate that the staff of the LSC math lab has continually improved in its ability to encourage students to complete their prescribed course in Math 179.

15. Analysis of Variance and Orthogonal Comparisons of Ethnicity with Diagnostic Math Pretest-To-Posttest Change Scores

A one-way analysis of variance was performed on the data to test the null hypothesis that there was no significant difference among the three major ethnic groups--White Americans, Black Americans, and Hispanics--as measured by the diagnostic math test pre-to-posttest change scores. The data for three of the four terms (1976-1, 1976-2 and 1976-3) showed a significant difference in the change scores among the three ethnic groups. The data for the 1976-4 term showed no significant difference among the change scores for these groups.

The analysis of variance was followed by orthogonal comparisons to determine which contrasted groups showed significant differences. White American students scored significantly higher than Black American students in the 1976-1 term and 1976-3 term; however, no significant differences were found in change scores for this contrasted group in

the 1976-2 and 1976-4 terms. No significant differences in the change scores between White American students and Hispanic students were found in any of the four terms. Hispanic students scored significantly higher than the Black American students in the 1976-2 term but showed no significant difference in the 1976-1, 1976-3 and 1976-4 terms. When the mean change scores for each ethnic classification were combined over the four-term period, the White American students' scores had increased 6.80 points, the Hispanic students 6.47 points and the Black American students by 3.98 points.

To summarize and place these findings in the appropriate context, the pretest diagnostic math scores in eight of the twelve contrasts showed a significant difference (Table 8). These differences between contrasted groups after the LSC instruction were reduced to three of the twelve contrasts (Table 16). These findings would indicate that the LSC staff was successful in teaching mathematics to a diverse ethnic population and were able to minimize the differences among these ethnic groups as measured by the pre-to-posttest change scores. It is recommended that the LSC staff continue to be aware that the differences are more pronounced with the Black American students when contrasted with the other ethnic groups and that more attention and encouragement is needed for the Black population served by the math instructors in the Learning Support Center.

16. LSC Math 179 Students' Diagnostic Math Pretest-Posttest Mean Scores and t Tests

The t test was used to test the null hypothesis that there was no significant difference between the diagnostic math pretest mean scores and the posttest mean scores for students enrolled in the Math 179 courses.

The data for performing these tests included students who received A, B, C, D, and F grades in the classes for the four terms in the 1976 academic year.

All four of the t tests showed a significant difference at the .001 level or less. Therefore, it was concluded that the posttest mean scores in the Math 179 classes were significantly higher than the corresponding pretest mean scores.

These findings indicate that the LSC staff has been successful in improving the math scores as measured by the diagnostic math test for students who enrolled and received A, B, C, D, and F letter grades in the Math 179 classes.

Conclusion

From this study it can be concluded that the Learning Support Center has been responsive to the individual needs of students who register in the LSC for math. The goal of the LSC to offer a developmental math program rather than a remedial math program has been met. Through the pretest program the students' math proficiency was identified, and through individualized instruciton the students were able to strengthen their math skills as evidenced by the posttest results.

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